DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, D.C. 20314-1000

CECW-CE

ER 1110-1-12

Regulation
No. 1110-1-12

21 July 2006

Engineering and Design
QUALITY MANAGEMENT

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This regulation supersedes ER 1110-1-12 dated 1 June 1993 and EC 1110-1-105 dated 31 December 2004.

CHAPTER 1

INTRODUCTION

1-1. Purpose. This engineer regulation (ER) provides policy, guidance, principles, practices and tools for delivering quality products and services to customers of the U.S. Army Corps of Engineers (USACE).

1-2. Applicability. This regulation applies to (USACE) commands responsible for providing products and services in all program areas.

1-3. Distribution. Approved for public release; distribution is unlimited.

1-4. References. Appendix A lists referenced documents.

1-5. Definitions. A glossary of definitions is at Appendix. B.

1-6. Quality Management System. All USACE organizations and functional areas must regularly employ effective, documented quality management systems per ER 5-1-11.

1-7. Roles and Responsibilities. Roles and responsibilities for quality management activities are stated ER 5-1-11 and the USACE PMBP Manual.

1-8. Project Quality Documents. Delivery of quality products and services requires an understanding of the important quality management documents, including the following:

a. Project Management Plan (PMP). In accordance with ER 5-1-11, a PMP is required for the execution of all work. The PMP identifies the scope, schedule, and resources needed to accomplish the work. It has sections that detail how the project work items will be accomplished. The customer/local sponsor participates in development of the PMP and endorses it once completed.

b. Quality Management Plan (QMP). The QMP is the quality component of the PMP. Its purpose is to document the project-specific quality control and quality assurance procedures appropriate to the size, complexity, and nature of the project. The QMP will identify customer quality objectives, and their thresholds, and project specific requirements determined by the command. The QMP will include Quality Control Plans and Quality Assurance Plans required for product deliverables and identify quality control and quality assurance requirements for the overall project, including work performed by contractors. The QMP must be consistent with the organizational QM unless otherwise documented.

c. Quality Control Plan (QCP). The QCP is the quality control component of the QMP and defines how quality control will be executed for products and services. Refer to Chapters 2 and 3 for further guidance.

d. Quality Assurance Plan (QAP). The QAP the quality assurance component of the QMP and defines how quality assurance will be executed for products and services that are

completed by outside resources, including architect-engineer (A-E) contractors as well as other USACE Districts and Centers. Refer to Chapters 2 and 5 for further guidance.

e. Contractor Quality Control Plan (CQCP). The CQCP is a written plan, provided by an A-E contractor that defines how quality control will be executed on products and services that are completed with A-E resources. Refer to Chapters 2 and 3 for further guidance.

1-9. Plan-Do-Check-Act Cycle. The 'Plan-Do-Check-Act' (PDCA) Cycle (commonly referred to in industry as the Deming Cycle) is the guiding quality management procedure for USACE business processes. The quality management policies and procedures of this regulation are organized and presented by their associated PDCA phase. The PDCA cycle is illustrated in Figure 1-1. The purpose of each PDCA step is summarized as follows.

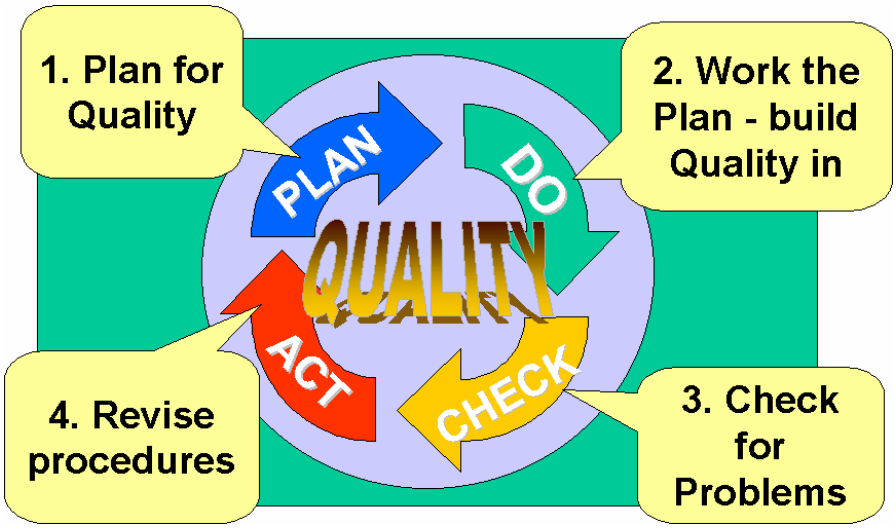
a. Plan - design the Project Management Plan to achieve customer requirements and provide for high quality products and services.

b. Do - implement the PMP, including the quality control and quality assurance procedures.

c. Check – evaluate the project results.

d. Act - identify and implement process changes for continual improvement.

Figure 1-1. Plan-Do-Check-Act Cycle



CHAPTER 2

'PLAN' PHASE – QUALITY PLANS

2-1. General. The Project Management Plan (PMP) is the primary document to guide delivery of a high quality project. During the project planning phase, the Project Manager will lead the PDT in development of an effective PMP that complies with USACE PMBP Manual guidance (http://pmbp-dev.lrd.usace.army.mil), including the following processes:

PROC2000	PMP/PGMP Development
PROC2010	Project Scope and Customer Requirements
PROC2020	Team Establishment
PROC2030	Activity/Schedule Development
PROC2040	Resource Estimate Development
PROC2060	Overall Acquisition Strategy
PROC2070	PMP/PGMP Approval

2-2. Quality Management Plan - REF8008G. The QMP is an integral part of the PMP. Quality is planned for and managed in accordance with the QMP, which includes the QCP and QAP. REF8008G of the PMBP Manual provides standards for the QMP. The PM, in concert with the PDT, is responsible for determining the procedures necessary to achieve the level of quality required by the project. PDT members will ensure that the customer's quality objectives are effectively defined and clearly articulated in the QMP.

2-3. Quality Control Plan (QCP). The QCP is a component of the QMP and PMP. The QCP is a written plan that defines how quality control will be executed for products. The initial QCP is prepared by the PDT during the project planning phase and is implemented during the project execution phase. The project QCP may be updated or product-specific QCPs may be published as required during project execution. Chapter 3 describes quality control procedures typically addressed in the QCP.

a. At a minimum the QCP will describe how Independent Technical Review (ITR) will be performed; list the PDT and ITR Team members and their review responsibilities; state the risks inherent to the project; and address any special considerations and/or crucial design features that must be addressed.

b. A minimal treatment or generic QCP may be used for small scope or repetitive products. Professional judgment, assessing risk management considerations, will guide the decision to use a generic QCP. The PM and the lead technical function manager will decide whether a project warrants a generic QCP. Parameters affecting this decision may include: potential for loss of life, health and safety; potential for significant property damage; complexity of the project; construction costs; costs of design and potential redesign; and environmental impacts.

c. The technical leader (e.g. project engineer/architect) will be the lead preparer of the QCP, and will involve other PDT members as required. Technical supervisors and the ITR Team will review the QCP before it is finalized.

2-4. Quality Assurance Plan (QAP). The QAP is a component of the QMP and PMP and is prepared by the PDT during the project planning phase. It is a written plan that defines how quality assurance will be executed on products that are completed with another District, government agency, or A-E resources. The QAP is implemented during the project execution phase. Chapter 5 describes quality assurance procedures typically addressed in the QAP.

a. The QAP defines an approach to ensure that the A-E's or supporting District's quality control program is being undertaken properly.

b. At a minimum the QAP shall describe how quality assurance will be performed; list the team members responsible for QA review; state the risks inherent to the project; and address any special considerations and/or crucial design features that must be addressed by another District, government agency, or A-E firm.

c. The technical leader (e.g. project engineer/architect) will be the lead preparer of the QAP, involving other PDT members as required. The technical supervisors and the ITR Team will review the QAP before it is finalized.

2-5. Other Quality Related PMP Components. The PDT will ensure that other key PMP components are structured to optimize project quality.

a. Production Schedule – PROC 2030. All projects and associated technical documents will have a formal production schedule in accordance with Activity/Schedule Development - PROC2030. This schedule will identify individual tasks to be accomplished, time duration for each task, responsible offices for the tasks, funds scheduled for each task, and primary milestone dates. The appropriate office and PDT member will furnish the schedule to the PM. The PM will coordinate the draft schedule among all offices for comments and commitments. Once finalized and validated by the PM for funding and project objectives, the schedule will be entered into the P2 system and distributed to all offices for scheduling work and meeting commitments. The PM in concert with the PDT will maintain the schedule and revisions will be made periodically to reflect ongoing actions.

b. Risk Management Plan - REF8007G. A Risk Management Plan is required for the PMP. The PM will effectively engage with the customer and other PDT members to identify risks to project scope, quality, schedule and cost. These risks will be clearly defined in the project Risk Management Plan. The PDT will ensure that the necessary work breakdown activities and resources are specified in the PMP to effectively address the defined risks. Starting with the PMP, Resource Providers and Independent Technical Review Team (ITRT) members will provide continuous review to ensure that the PDT has adequately defined and addressed project risks.

c. Value Management Plan - REF8023G. A Value Management Plan is required for the PMP. The USACE Value Management/Value Engineering (VM/VE) program requirements are published in ER 11-1-321. The PDT will ensure that the Value Management Plan effectively applies VM/VE policies and procedures to provide the best value project for the customer.

d. Change Management Plan - REF8009G. Change Management Plan is required for the PMP. The CMP will stipulate performance metrics for project scope, schedule, cost, quality and risk. PDT and ITRT members will evaluate all proposed project changes and report potential impacts to the performance metrics per the project Communications Plan. The goal for the change management process will be to optimize project performance and customer satisfaction throughout the project life cycle.

2-6. PMP/PGMP Approval - PROC2070. PROC2070 provides guidance for approval of the PMP. In addition, an ITR of the draft PMP will be conducted prior to approval. When complete, the PDT members, including the customer representative(s), will approve the PMP by endorsement and forward it to the final approval authority.

CHAPTER 3

'DO' PHASE - QUALITY CONTROL

3-1. General. Quality Control (QC) is that part of quality management focused on fulfilling the project quality requirements defined in the PMP. It includes those processes used to ensure performance meets agreed upon customer requirements that are consistent with law, regulations, policies, sound technical criteria, schedules, and budget. Quality control of products and services consists of a number of processes and procedures to ensure quality products are realized. Basic quality control tools include a Quality Control Plan providing for seamless review; quality checks and reviews, PDT reviews, independent technical reviews (ITR); Biddability, Constructability, Operability and Environmental (BCOE) review; and quality control certification.

3-2. Products. Districts produce a broad variety of products including, but not limited to:

a. Civil Works Program – studies, engineering technical appendices for planning reports, design documentation reports, design analyses, and plans and specifications.

b. Military Program – full spectrum of military planning documents, studies, programming estimates, and design documents.

c. Environmental Program – various environmental studies, remedial investigations, and remedial designs.

d. Controlling guidance and regulations include ER 1110-345-100 and ER 1110-345-700 for military construction. ER 1110-2-1150 and ER 1110-2-1200 provide engineering guidance for civil works projects. ER 1105-2-100 provides guidance for conducting civil works planning studies, ER 1110-1-1300 specifies cost engineering policies for all programs, and ER 1110-1-8155 governs the preparation of specifications for all programs. ER 200-2-2 provides procedures for implementing NEPA. ER 200-1-5 provides guidance for implementing the Environmental Operating Principles. The PDT must ensure that it is applying the latest USACE policy to meet a project's quality objectives.

3-3. QCP Implementation. The QCP prepared by the PDT during the planning phase will be implemented during project execution. The PDT will update the QCP as required for changing project conditions. The PDT may also prepare additional QCPs for different phases and products, depending on nature of the associated work.

3-4. Field Investigation. A thorough examination of a project site and the collection of data on existing conditions (including existing structures and other features, topographic surveys, geotechnical data, utility information, and HTRW) are essential for the development of accurate construction plans. Ideally, the PDT should obtain all field investigation data to maintain continuity of responsibility. When existing data is provided to a designer, the designer must be allowed sufficient time and effort to assess the accuracy of the data.

3-5. Project Coordination. Regular coordination among the PM; PDT members; other Districts, government agencies, and A-E contractors (if applicable); ITR members; and customer or sponsor representatives is essential for a quality project. Coordination is necessary to ensure that the PMP is being followed and the quality objectives are being achieved, and to make adjustments as needed. The coordination includes frequent in-person, telephonic, written and e-mail communications, as well as pre-design conferences, progress and design review meetings, meetings on special issues, and visits to the project site. The PM is responsible for coordination with the customer and higher authority on the scope, schedule, funding and changes, and documenting as appropriate. Project scopes will be developed in accordance with Project Scope and Customer Requirements Definition - PROC2010. The PM will hold periodic meetings to discuss project issues, progress, production needs, and commitments. The appropriate management staff and technical lead should participate to offer technical guidance and direction to the team.

3-6. Quality Checks and Reviews. Quality checks and reviews are technical checks and reviews occurring during the development process. A quality check begins with the selection of qualified individuals to perform detailed review and check work. Quality checks must be carried out as routine management practice. Such review includes checking basic assumptions and calculations. Quality checks may be performed by staff responsible for the work, such as supervisors, work leaders, team leaders, designated individuals from the senior staff, or other qualified personnel and performed prior to ITR of the deliverable.

3-7. Project Delivery Team (PDT) Review. The PDT will normally include a variety of stakeholders, each with his/her own important project requirements and a different, but interlocking, review responsibility. All PDT members shall be knowledgeable about the critical project requirements of all their PDT counterparts, understand how their own particular project elements and work relates to and affects those requirements, and conduct their reviews to insure consistency and effective coordination across all project disciplines. The PDT review should include a comprehensive evaluation of: correct application of methods, validity of assumptions, adequacy of basic data, correctness of calculations (error free), and completeness of documentation, compliance with guidance and standards, and BCOE considerations. Also included as part of the CW PDT review is a plan-in-hand review at the end of development. Some typical reviewer roles include:

a. Major commands personnel should put their focus on space allocation provisions and compliance with project construction cost and delivery parameters (functional).

b. Installation—DPW and BCE—operability/maintainability personnel focus on the question – “Can the project be effectively and efficiently operated and maintained by base personnel?”

c. Using Agency Users and Civil Works Sponsors focus on function “Does the project fulfill the intended purpose?”

d. Special Interests Personnel (i.e., Chief of Chaplains, food service, Health Facilities Office, centers of expertise, etc.) ensure that their particular specialty is properly designed.

e. Fire Marshall checks for compliance with locally established fire protection requirements that supplement standard fire protection criteria.

f. Provost Marshall checks for security measures and requirements.

g. The Project Manager reviews the project for progress in accordance with the PMP (i.e., scope, schedule, and budget commitments).

h. Office of Counsel is responsible for legal sufficiency and identifying legal issues.

3-8. Independent Technical Review (ITR). All decision and implementation documents for a project will be subjected to an ITR. ITR procedures are addressed in Chapter 4.

3-9. Biddability, Constructability, Operability and Environmental (BCOE) Review. All implementation documents being finalized for a construction contract advertisement will be submitted to the Construction and Operations organizations for a BCOE review consistent with ER 415-1-11. Ideally BCOE reviews should occur after the ITR is complete and all ITR comments resolved.

3-10. Design Review and Checking System (DrChecks[sm]). DrChecks[sm] is a module in the ProjNet[sm] suite of tools developed and operated at ERDC-CERL (www.projnet.org). DrChecks[sm] facilitates and documents the formal review of project documents. DrChecks[sm] will be used by the PDT to manage all project reviews. Guidance for DrChecks[sm] implementation is provided in ER 1110-1-8159.

3-11. Documentation. The technical team leader will maintain a file of quality control records for the project. Documents to be stored in the project quality control file will include, but not be limited to: the QCP; annotated comments in DrChecks[sm] for reviews; and QC certifications.

CHAPTER 4

'DO' PHASE - INDEPENDENT TECHNICAL REVIEW (ITR)

4-1. General. Independent Technical Review (ITR) is a review by a qualified person or team not involved in the day-to-day production of a project/product, for the purpose of confirming the proper application of clearly established criteria, regulations, laws, codes, principles and professional practices. All products will be subjected to an ITR. ITR is a holistic, comprehensive review of the project. While ITR is a critical component of quality control, it will not replace checks or other quality control processes. Each ITR team member should review each product for consistency across the various disciplines of the project. ITR team members must also review his/her discipline's elements and how they impact and align with the project's functions. Comments will be limited to those that are required to ensure adequacy of the product; it will not be the reviewer's prerogative to dictate matters based solely on personal preferences.

4-2. ITR Objectives. The primary objectives of ITR are to ensure that:

a. The project meets the customer's scope, intent and quality objectives as defined in the PMP.

b. Formulation and evaluation of alternatives are consistent with applicable regulations and guidance.

c. Concepts and project costs are valid.

d. The recommended alternative is feasible and will be safe, functional, constructible, environmentally sustainable, within the Federal interest, and economically justified according to policy.

e. All relevant engineering and scientific disciplines have been effectively integrated.

f. Appropriate computer models and methods of analysis were used and basic assumptions are valid and used for the intended purpose.

g. The source, amount, and level of detail of the data used in the analysis are appropriate for the complexity of the project.

h. The project complies with accepted practice within USACE.

i. Content is sufficiently complete for the current phase of the project and provides an adequate basis for future development effort.

j. Project documentation is appropriate and adequate for the project phase.

4-3. ITR and Project Risk. ITR should be commensurate with the scope, complexity, risk and cost of the project. It is critical that appropriately experienced and technically expert personnel be assigned to both the PDT and ITR teams. The ITR team must be selected based upon factors such as the project scope, complexity and size; sponsor/customer expectations; public scrutiny; life safety; technical expertise required; overall knowledge of the Corps' business processes; and other appropriate guidelines.

4-4. ITR Team Membership. ITR team members will demonstrate senior-level competence in the type of work being reviewed. Junior-level staff cannot be members of ITR teams without appropriate senior-level technical monitoring. For most projects, ITR members should be sought from the following sources: regional technical specialists (RTS); appointed subject matter experts (SME) from other Districts; senior level experts from other Districts; Center of Expertise staff; appointed SME or senior level experts from the responsible District; experts from other USACE commands; contractors; academic or other technical experts; or a combination of the above. ITR should be performed outside of the responsible command for large and/or complex projects, high-risk projects, and when the responsible command does not have sufficient resources to conduct proper ITR. All ITR teams should strive to include personnel who are registered in their field of expertise, if applicable. While the selection of the ITR team and team leader is ultimately the responsibility of the command managing the project, it may be appropriate to obtain recommendations for ITR team members from outside the command such as from other Districts, other Regional Business Centers (RBC), HQUSACE, Centers of Expertise, or expert groups outside USACE.

4-5. ITR Team and PDT Relationship. Appropriate and separate PDT and ITR teams will be established during the initial PMP development. ITR reviews shall be conducted as necessary to ensure that the product is consistent with the PMP and established criteria, guidance, procedures and policy. ITR team members will be identified in the PMP and appropriate QCP, and any personnel changes are to be coordinated with the PM and reflected by updating the QMP. The ITR team must assure independence from the PDT by not becoming involved in the routine day-to-day production decisions, including formulation, evaluation, analyses, design, or value engineering studies. However, the ITR team will be available to act as advisors to the PDT during production. ITR should focus on offering the advantages, disadvantages and concerns of options considered by the PDT, and offer any other alternatives and/or better practices not considered by the PDT. The PM must ensure that the ITR team maintains situational awareness with respect to project challenges and opportunities. This could include, at a minimum, scheduled periodic project briefings and site visits. The PDT is responsible for production decisions.

4-6. Seamless Review. The ITR process shall be a continual process with formal reviews coordinated with the PDT at critical points, saving time and money, and minimizing unproductive design effort and rework. ITR team members will be available, knowledgeable, and willing to offer guidance as major issues arise. PDT members will be encouraged to seek concurrence from the ITR throughout the product delivery process through formal venues as prescribed in the PMP. The PM is responsible to ensure appropriate dialogue occurs between the ITR team and the PDT. The ITR team will furnish the PDT feedback at critical points during project formulation and design, and will conduct formal reviews at scheduled

milestones and as products are completed. Formal ITR of products only occurs when a holistic, comprehensive review of the overall product is performed.

4-7. Formal Reviews. The ITR team will document its comments and recommendations, for all formal reviews, utilizing the DrChecks[sm] module in ProjNet[sm] in accordance with ER 1110-1-8159. Comments will be structured to give a clear statement of the concern, the basis of the concern and, when appropriate, the actions necessary to resolve the concern. Comments will cite appropriate references. The PDT will evaluate and respond to each comment in DrChecks[sm]. Responses will clearly state concurrence or non-concurrence with the comment. Concurrences shall include what the corrective action is and where and when it will be done. Non-concurrences shall include an explanation or proposed alternative action. All comments are to be resolved and back checked in the DrChecks[sm] project record prior to ITR certification. The ITR team should also use the Design Quality Lessons Learned (DQLL[sm]) module in ProjNet[sm] to document project lessons learned.

4-8. Informal Reviews. The ITR team and PDT will periodically communicate throughout the project development process. The ITR team will render comments and recommendations to the PDT from time-to-time to avoid lost effort due to technical error.

4-9. Editorial Comments. Some comments and suggestions are about minor issues, while valid, may best be made informally, in parallel with but external to the official ITR process, in order to ensure the ITR focuses on significant deficiencies. However, a large number of editorial errors indicate that the QCP/QAP have not been followed and should be noted by a single comment in the review. Examples of comments best handled informally include:

a. Spelling, grammar, format or language in the report.

b. Minor numerical errors, which do not affect validity of the results.

c. Other issues that will not contribute towards a safer, more functional, or more economical project.

d. Repetitive comments on same subject where one comment is adequate.

4-10. Statement of Technical Review and ITR Certification Process. The ITR leader must complete a statement of technical review for all final products and final documents. In the case of civil works decision documents forwarded to HQUSACE for review, a statement of technical review will accompany both draft and final documents. A certification by ITR team leader, project manager, and the chief of the function that the issues raised by the ITR team have been resolved is required as part of the statement of technical review. Sample statements of technical review and certification of ITR are included at Appendix E. When an A-E performs the ITR, the appropriate principal of the contractor shall sign the statement. Sample statements of technical review and certification of ITR for an A-E contractor are included as Appendix E. Commands may modify the statements to fit local needs.

4-11. Engineering Technical Appendix (ETA) for Civil Works Planning Reports. An ETA will be reviewed for technical adequacy prior to being incorporated into the planning report. The complete planning report, including the ETA, in turn, will be subjected to an ITR per planning policy and guidance. Planning policy requires that the overall ITR be performed outside of the responsible command for all feasibility and post authorization studies.

4-12. District and Center Responsibilities. The command that has project management responsibility for a project is responsible for ensuring that ITR is performed and certified within established guidelines. As such, the command must assure that all requirements and processes are understood and followed. Each command will have procedures in its QMS defining:

a. ITR Requirements. Determine the ITR requirements for the product in accordance with this ER.

b. ITR Team Selection. Selection of the ITR team leader and ITR members in accordance with Team Establishment – PROC2020.

c. Resources. Resources (time and funding) available for the ITR members in accordance with Resource Estimate Development - PROC2040.

d. Change Management Process. How resources or ITR members are changed in accordance with Change Management - PROC3010.

e. Process for ITR Comment Resolution. The PM and Technical Team Leader are responsible to facilitate contact between the ITR team and the PDT throughout the project development process. When the PDT does not concur with an ITR comment, the best means of resolution will normally be a discussion between PDT and ITR team members. When such a discussion does not result in an appropriate resolution, the issue must be elevated through the chain of command. The ITR team does not have authority to cause resolution of comments; the authority for comment resolution lies with the chain of command. The chief of the engineering function in the PDT command is the final authority for resolution of ITR comments. The Regional Headquarters may be asked to act as an informal sounding board for an unresolved issue, or may be asked by the District to resolve the issue. All comments in the DrChecks^{sm} module will be back checked against the final documents prior to closing and issuing the ITR certification.

f. Architect Engineer (A-E) Contractors. A-E contractors will typically be required to accomplish ITR of their products as part of their quality control process, also using the DrChecks^{sm} module of ProjNet^{sm}, and the responsible USACE command will perform quality assurance. USACE may, on an exception basis, perform an ITR to integrate the products of multiple A-E contractors or a single, comprehensive ITR of the product is otherwise required. An example may be if an A-E contractor performs the geotechnical and structural design while the civil and electrical design is either performed in-house by the USACE command or by another A-E contractor. These exceptions must be documented in the PMP

and the A-E contract(s). The A-E contractor is still responsible for quality control of its work. The USACE command is responsible for policy compliance on all projects.

4-13. Regional Business Center Responsibilities. With its quality assurance mission and Quality Management System, the RBC is responsible for the effectiveness of ITRs across the region.

a. The RBC quality assurance (QA) manager provides oversight of the QMS and the ITR processes in the RBC and is the point of contact for the subordinate districts and HQUSACE for ITR issues. The RBC QA manager will serve as the regional champion for quality.

b. ITR selection, issue resolution, certification processes, and quality assurance of A-E contractors, including use of the DrChecks[sm] module, will be reviewed during quality audits of Districts.

c. RBC staff will be responsible for review, acceptance and dissemination of identified lessons learned and best practices. The RBC will use RTSs and SMEs to assist in this effort. Project-specific issues will be conveyed to the appropriate District Support Team, the RBC and the appropriate CoPs.

CHAPTER 5

'DO' PHASE - QUALITY ASSURANCE

5-1. General. Quality Assurance (QA) is defined as that part of quality management focused on providing confidence that project quality requirements defined in the PMP will be fulfilled. QA includes those processes employed to assure that QC activities are being accomplished in accordance with planned activities and that those QC activities are effective in producing a product that meets the desired end quality.

5-2. Responsibilities. For products or services being prepared by the owning District or activity, QA will be performed by the Regional Headquarters. QA responsibility is delegated to the District for designs prepared by another District, government agency, or A-E contract.

a. The Regional Headquarters will conduct its QA activities using an audit process defined by its regional QMS.

b. Districts or Centers will conduct QA actions including preparation of a Quality Assurance Plan; review and approval of another District, government agency, or A-E QCP; and Quality Assurance oversight.

5-3. QAP Implementation. The QAP prepared by the PDT during the planning phase will be implemented during project execution. The PDT will update the QAP as required for changing project conditions. Or, as the project progresses, the PDT may prepare additional QAPs for different phases and products, depending on nature of the associated work.

5-4. Management of Technical Products. Following the PMBP, Division Chiefs, Branch Chiefs, and Section Chiefs are responsible for guiding and ensuring that all technical documents are developed and finalized to result in high quality products. This will be done both from a presentation perspective to meet accepted professional standards and in substance to effectively respond to project requirements and objectives. Management procedures must be established to ensure technical products and project construction are of high quality and consistent with applicable technical policies and professional practices. Management will ensure that the PDT identifies and utilizes professional standards including legal, environmental, economic, code, life safety and health. The technical chiefs and PM are responsible for deciding how production work will be accomplished using such options as in-house capability, A-E firms, and other Districts and government agencies.

5-5. A-E Selection and Management. FAR Part 36 and the supplements thereto, as well as EP 715-1-7, will be followed for the procurement of private sector A-E services. Appropriate members of the PDT will prepare a thorough SOW for the A-E services in accordance with Project Scope and Customer Requirements Definition - PROC2010, participate in the selection of a highly qualified A-E firm, prepare an Independent Government Estimate, assist in contract negotiations, coordinate and oversee the A-E contractor's performance, and perform quality assurance of the contractor's product. A qualified person in product development will be appointed as the contracting officer's representative (COR) for the A-E contract, however the

PM may be appointed as the COR, if properly qualified. The COR is responsible for management of the A-E contract and ensuring that the contract requirements are satisfied.

5-6. Other Districts and Government Agencies. Appropriate members of the PDT will prepare a thorough SOW in accordance with Project Scope and Customer Requirements Definition - PROC2010 for the services of other Districts and government agencies, and perform quality assurance of the product.

5-7. Oversight. The District PDT will review documents prepared by another District, government agency, or A-E firm to ensure contract compliance and to verify that the appropriate criteria and assumptions were used. This effort should not be an in-depth technical review, but should be performed to the degree necessary to satisfy the reviewer that the Government is receiving a full response to contract requirements. Also, the District must be prepared to present the product when engaging with the customer. Typical QA activities include:

a. Review and approval another District, government agency, or A-E prepared QCP.

b. Ensure that described activities of another District, government agency, or A-E QCP have been/are being performed.

c. Verify designers and checkers are same staff as proposed in another District, government agency, or A-E's SF 330 and identified in the QCP.

d. Verify ITR reviewers are same staff as identified in the QCP.

e. Ensure an ITR is conducted in accordance with Chapter 4, with emphasis on a determination that the ITR was appropriate to the level of risk and complexity inherent in the project; that the ITR verified compliance with established policy principles and procedures; utilized justified and valid assumptions; and reviewed methods, procedures, alternatives, and reasonableness of results, including whether the product meets customer's needs.

f. Verify appropriate staff in another District, government agency, or A-E have completed and signed the required QC certifications.

g. Ensure all QA review comments have been adequately resolved in future submittals.

h. Verify the product received satisfies contract requirements.

i. Visits to another District, government agency, or A-E's office.

j. Frequent dialog between another District, government agency, or A-E and the District to ensure the project will satisfy the Corps requirements and avoid lost effort.

5-8. Documentation. When another District, government agency, or A-E completes product development, the following information will be kept with the project file: QAP; QCP; annotated

comments in DrChecks[sm] for QA reviews; another District, government agency or A-E statement of technical review; and QA Certifications (refer to Appendix F).

CHAPTER 6

'DO' PHASE - DESIGN RESPONSIBILITY

6-1. General. In addition to addressing the validity and accuracy of the design effort, the subject of design responsibility encompasses several other areas of professional accountability. These include both legal and financial accountability, state professional licensing issues, and the process of establishment and control of a unique and legally identifiable Engineer of Record. This chapter covers the Corps of Engineers policies concerning these issues. Appendix H presents the official position of the United States Government in addressing the doctrine of Federal Supremacy in regards to state professional registration requirements.

6-2. Engineer of Record. The Engineer of Record (EOR) is defined as the individual who is ultimately responsible and liable for the adequacy and safety of a design. ER 1110-345-53 covers the EOR responsibility for structural steel connections. EOR responsibility for all other structural design is covered by ETL 1110-3-447. For in-house designs, the Engineer of Record (EOR) is designated as the chief of the engineering function. A summary of the requirements of these documents is found in Appendix G.

6-3. Design Liability. Design liability is defined as legal and financial accountability for the adequacy and safety of a design. Design liability rests with the EOR.

6-4. Design Responsibility. Design responsibility means the final and total responsibility for assuring the correctness of design, specifically the adequacy and safety of the structure or system. Design responsibility also includes the element design liability.

6-5. Direct Supervisory Control. This is a term utilized by state boards of professional registration as an absolute requirement before a registered engineer may sign/seal professional work. It means that this individual has direct control or dominion over the work and has the ability to control the direction and scope of the project at any point in time. They are not required to perform all the drafting, calculations, reproduction, and computer techniques that can be done by others, but direct input, control and ability to change the documents must remain with the responsible professional engineer. They must be qualified professionally through experience or training to do the work. Finally, they may sign only that portion of the work developed by the registrant or under his/her immediate personal supervision.

6-6. Professional Accountability. Designation of the Chief of Engineering Division or other equivalent position as the EOR does not relieve the individual designer and checker from accountability for the adequacy and safety of their design. Accuracy and quality of design effort will always serve as a factor in each designer's performance evaluation. Design accountability must always rest with those individuals who are performing and/or checking the actual design calculations or making critical decisions relevant to the project. For A-E developed products FAR Clause 52.236-23, "Responsibility of the Architect Engineer Contractor" clearly defines the responsibility of the A-E in performing work.

6-7. Procedures for Signature and Indication of Registration. The procedures for signature and indication of registration are:

a. Professional Registration. USACE requirements for professional registration for key technical management positions are identified in ER 1110-1-8152. USACE does not, however, require that registration be in any particular state. Requirements for professional registration for additional key positions are under continuous consideration in HQUSACE. Appendix H provides a detailed summary of a HQUSACE legal analysis of Federal Supremacy issues concerning state's authority to require professional registration for Federal projects. Under the doctrine of Federal Supremacy, USACE is not required to comply with state requirements except in those situations where Congress has waived the Federal Government's Supremacy. In the case of six environmental statutes (identified in Appendix H) Congress has waived Federal Supremacy and the Federal government must comply with state substantive requirements, permits and certifications. While this concession does not specifically address professional registration, Districts and RBCs are directed to cooperate with states in the spirit of partnership, while not unduly compromising Federal Supremacy. This wording implies that the use of professional stamps for design projects covered by any of these six environmental statutes (while not specifically a legal requirement) may be politically expedient.

b. Responsibility. District Chiefs of Engineering or equivalent position (or their designated deputies) will sign and date all in-house design documents and associated certifications, as well as all appropriate permit applications executed by the USACE. District Chiefs of Construction and Construction-Operations or equivalent position (or their designated deputies) will sign and date certifications required during or after construction. Districts are encouraged to contact HQUSACE for guidance concerning unusual situations. The responsible professional's signature will be followed by "P.E." (Professional Engineer), "R.A." (Registered Architect), or another appropriate designation indicating that the signer is currently a registered professional. All documents may be sealed or stamped, rather than using the "P.E." or "R.A." designation, at the discretion of the District. This responsibility may be further delegated to appropriate subordinate senior registered professionals. When a District Chief (or deputy) is not a registered professional, this responsibility will be delegated to appropriate senior registered professionals. Any delegation must be reflected in the individual registered professional's position description and in specific written District procedures. Individuals signing in accordance with this paragraph are required to do so within the scope of their employment.

c. Architect–Engineers. A-E contracts will require the contractor to sign and stamp or seal and date at least one set of design documents, permit applications or certifications. The deliverables under each contract for A-E design services will include: one set of properly signed, stamped or sealed and dated drawings; a certified cover document showing for each discipline the name and stamp or seal of the professional who supervised the work, and the date each stamp or seal was affixed; or an electronic signature that indicates for each discipline the name, stamp or seal of the professional who supervised the work, and the date each stamp or seal was affixed.

CHAPTER 7

'DO' PHASE - CONSTRUCTION QUALITY

7-1. General. Obtaining quality construction is a combined responsibility of the construction contractor and the Government. The Construction element and Area/Resident Offices, as applicable, plan, coordinate, and manage the Construction Quality Management Program, plan and coordinate partnering of construction contracts, manage the Resident Management System (RMS), and monitor and evaluate CMR performance. Many of these tasks are accomplished using the RMS. In accordance with ER 1180-1-6, Construction Quality Management, Construction Branch and Area/Resident Office PDT members perform quality assurance of construction products.

7-2. Engineering Support. The PDT will give priority to supporting construction contract activities, as response time is critical to ensure cost effective contract execution. The PM will ensure that the engineer support to construction is adequately resourced. An Engineering Considerations and Instructions for Field Personnel (ECIFP) document will be prepared in accordance with Appendix G, ER 1110-2-1150. Field visits by the appropriate PDT members are encouraged to verify conditions assumed during the design phase and offer technical support to the field staff relative to design intent. Needed changes to the contract documents will be formalized and initiated by field personnel with the appropriate coordination and review by the designers.

a. Engineering Considerations and Instructions for Field Personnel (ECIFP). An ECIFP is a brief document outlining the engineering considerations used to formulate and design. It should include the project discussions on why specific designs and materials were selected and any features requiring special attention. The document should provide insight and background necessary to review submittals and resolve minor construction problems without compromising design intent. ECIFP is used to transmit special design concepts, assumptions and instructions on how to construct unique design features and is the means of communication and coordination between design and construction personnel for preconstruction and preparatory meetings, submittal reviews, shop drawings, samples, certifications, and test results.

b. Contractor Submittal Requirements. ER 415-1-10 provides guidance on Contractor Submittal Procedures. Submittals, which require approval, are: extensions of design, critical materials, deviations, O&M manuals, or equipment that must be compatible with the entire system. The designer prepares the Submittal Register using SpecsIntact indicating the list of submittals required and further designating submittals require Government Approval (G) by the District Office (DO) or A-E (AE). The number of G submittals should always be kept to minimum. Submittal items not designated with a G are considered as being for information only (FIO) for Army projects, which is the default classification. SpecsIntact provides a submittal data file for RMS import. All submittals are tracked in RMS. G submittals requiring DO or AE review and approval include:

(1) Critical construction features are expressed in terms of performance standards with design details responsibility of contractor.

(2) Any deviation prior to construction requires documentation per ER 1110-1-8152, Changing USACE/A-E Designs.

(3) Fire Protection Systems – refer to ER 1110-1-260.

(4) Structural Steel Connections – refer to ER 1110-345-53.

(5) HVAC Commissioning – refer to ER 1110-345-723.

(6) Pre-manufactured metal buildings and other special systems.

c. Site Visits. A schedule of visits to the construction site by design personnel should be established. Site visits are made to verify that field conditions match those envisioned during project design and to discuss any issues concerning construction with appropriate field personnel. Guidance for construction site visits by design personnel is in ER 1110-2-112.

d. Design Modifications. Engineering will review all construction changes that have a significant impact on design, including VECP, waivers and system changes, to ensure that design intent, safety, health and environment requirements are not compromised. Modifications will be reviewed for design deficiencies that may require changes in design criteria.

7-3. Operation and Maintenance (O&M) Plans, Manuals and Training. A major component of the user's overall impression of the quality of the facility received is its operability. An O&M manual is a comprehensive plan for properly operating and maintaining a facility. Onsite training of base/sponsor O&M personnel may also be included to shorten the learning curve and provide familiarization of complex systems as the new facility comes on line. ER 1110-345-723, Systems Commissioning Procedures, provides requirements for MILCON projects. At the pre-design conference, the need for an O&M plan or systems commissioning should be discussed on projects such as: power plants; water treatment plants; sewage treatment plants; mechanical equipment and electrical systems; medical facilities; and Air Force projects. Preparation of the O&M manuals and training should be included as an option in an associated A-E contract. The Corps' project engineer/architect has the responsibility to exercise this option at the proper time during the final stages of design. The A-E must also ensure the plan and manuals are properly prepared and completed in the timeframe specified in the A-E contract. The Corps' project engineer/architect must coordinate with construction representatives to determine the optimum time to exercise this option. The A-E must also, to some extent, help facilitate the flow of data from the contractor to the A-E and help coordinate training dates with personnel to be trained. For in-house designs, normally the contractor is tasked with preparing the Systems Commissioning Plan, related manuals and conducting training.

7-4. As-Built Drawings. The Construction contractor generally prepares final as-built drawings in the specified electronic format. As-built drawings should be included on the submittal register as necessary to incorporate extensions of design by the construction contractor. Engineering provides QA review of working as-built drawings and approves the final drawings.

7-5. Resident Management System (RMS). The Government module of RMS is the automated construction management/quality assurance information system that shall be used for monitoring and administration of all construction contracts. The Contractor uses the Government furnished Quality Control System (QCS) module of RMS to record, maintain, and submit various information throughout the contract period. Unified Facilities Guide Specification (UFGS) Section, Quality Control System (QCS), is the guide specification that covers the requirements of the QCS for contract monitoring and administration. QCS is not required for small, simple, short duration construction contracts or for contracts where its use would not be beneficial overall. The joint Government-Contractor use of RMS and QCS facilitates construction planning, contract administration, quality assurance, payments, correspondence, submittal management, safety and accident administration, modification processing, and management reporting. QCS is included in the construction solicitation, when needed.

7-6. Transfer and Warranties. Transfer and warranties will be conducted in accordance with ER 415-345-38. The UFGS Section, Closeout Submittals, outlines several additional items, which should be considered for inclusion in the contract documents.

CHAPTER 8

'DO' PHASE – DESIGN-BUILD METHOD

8-1. General. ER 1180-1-9 Design-Build Contracting prescribes procedures for use of the design-build project delivery method. The regulation stipulates the traditional design-bid-build method or, with limits, the non-traditional design-build (D-B) method may be used for project delivery, as appropriate. With the D-B method, the contractor provides integrated design and construction services. USACE performs quality assurance. This chapter prescribes quality management provisions for the design-build method.

8-2. D-B Contractor Responsibilities. With D-B the contractor is the single point of responsibility for the design and construction services. The PDT is responsible for the quality of the design performance criteria in the D-B solicitation. The D-B contractor is otherwise responsible for design quality. The PDT will ensure that appropriate design quality control provisions are included in the D-B contract. PDTs should refer to D-B contracting guidance at http://www.hnd.usace.army.mil/techinfo/support.htm. Contract provisions relating to design responsibility and quality include, but are not limited to:

a. Design Phase.

(1) Higher Standard of Care. Compared to an A-E contract, the D-B Contractor and its Designer of Record (DOR) are charged with a higher standard of care to correct construction associated with faulty design.

(2) Contractor's Design Input. The contract will have provisions for the contractor's construction function to provide input during the design. The D-B Contractor's construction function will address constructability, coordination, and ensure that the project cost is within the contract budge/price amount.

(3) Warranty of Design. The D-B contract will include "Warranty of Design" provisions that provide for an extended callback for design errors and omission, and for correction of construction related to faulty design

(4) Quality Control. The D-B contract will address QC for design and design related activities during construction. The UFGS Section, Contractor Quality Control, has tailoring options to require the D-B Contractor to implement design quality control and is available in the SpecsIntact format. As a minimum, the design QCP must designate a qualified design quality control manager, incorporate independent, peer reviews, utilize a design deficiency tracking system and develop procedures for design reviews and for DOR reviewed and approved construction submittals.

(5) Design Submittals. The contract will address the requirements for D-B Contractor prepared design submittals. The contract will allow the D-B Contractor to package the design to fit the overall schedule. Within limits, the contract will also indicate when staged submittals are required before construction start for USACE review to ensure the design

meets the contract requirements. The contract will establish minimum format and content requirements for staged submittals and define the PDT's design review role. It will also require the use of DrChecks[sm] and RMS for tracking comments and submittals respectively.

b. Build Phase.

(1) DOR Quality Role. The D-B Contractor, through its DOR, will ensure the project construction is in accordance with the accepted design and the contract. The DOR's quality role during construction includes, but is not limited to, reviewing and approving shop drawings, correcting design errors and omissions, revising the design for official changes and approved deviations, resolving field questions or problems and approving final as-built drawings.

(2) Construction Submittals. The D-B contract will require the Contractor's DOR to assume the PDT's traditional role of technical review and approval of construction submittals. The DOR will review and approve proposed changes to the accepted design and forward them to the PDT for review. The UFGS Section, Submittal Procedures, addresses requirements for D-B contracts and is available in the SpecsIntact format.

(3) As-Built Documentation. The D-B contract will require the Contractor's DOR to review, sign and stamp as-built documentation. The D-B Contractor will prepare as-built drawings in the specified electronic format, and the drawings will be a closeout submittal for the end user.

(4) Value Engineering. Formal value engineering will normally only be conducted during the build phase, and not during the design phase. The D-B contract may include a clause that allows the D-B Contractor to submit value engineering change proposals (VECP). During the build phase the contract will have been awarded based on performance and prescriptive requirements of the D-B request for proposal. Since the performance requirements of the Request for Proposal (RFP) are considered essential and form the basis for evaluating the proposal, only the prescriptive requirements can be changed through value engineering change proposals (VECP), and only as long as the essential functions defined by those requirements remain unimpaired. Further, if the VECP affects an evaluation factor that was used to determine the award, the PDT will not accept it.

8-3. Project Delivery Team (PDT) Responsibilities. The Project Delivery Team's role for a D-B project is one primarily of quality assurance. ER 1180-1-9 requires that USACE Districts develop formal design-build procedures to be approved by their Regional Headquarters. The PDT will follow the District's approved D-B procedures in the performance of its work. It is expected that PDT responsibilities for D-B will include, but not be limited to the following:

a. Request for Proposal (RFP) Phase. The PDT will develop and provide quality control review of the performance criteria and prescriptive requirements in the RFP. The PDT will review and evaluate D-B proposals for compliance with the contract requirements.

b. Design Phase. The PDT will perform quality assurance review of the D-B Contractor's design submittals. The review will be for general conformity with the design performance criteria and prescriptive requirements, and will not be in-depth, such as checking all design calculations.

c. Construction Phase. The PDT remains responsible for the quality of the design criteria and for assuring that the construction conforms to the accepted design as well as to the contract requirements. The PDT's role is that of quality oversight by concurrence of the DOR and contract quality control activities, including spot-checking submittals to ensure that they conform to the contract and accepted design. The PDT will also review value engineering change proposals. In order to not jeopardize or otherwise relieve the D-B Contractor of its single point of responsibility, the PDT will not overstep its QA role by directing or suggesting specific fixes or by approving design submittals, shop drawings and other submittals. The PDT will provide QA of as-built drawings.

d. Performance Appraisal. The PDT will evaluate the D-B Contractor's quality of performance, using the USACE Construction Contractor Appraisal Support System ("CCASS"). Inasmuch as past performance and previous experience have become effective evaluation factors in source and A-E selections, the PDT will record design performance on the D-B contract in the CCASS evaluation system. The PDT will include evaluation ratings and remarks regarding the design performance by the D-B Contractor or by a design subcontractor within the CCASS rating of the D-B Contractor.

CHAPTER 9

'CHECK' AND 'ACT' PHASES – CONTINUAL IMPROVEMENT

9-1. General. Continual improvement is a performance imperative for every command and is achieved through the review of project results, identification of non-conformities and systemic problems, tools for root cause analysis, and implementation of appropriate corrective actions. The process of continual quality improvement leads to the refinement of the overall quality system. Processes and tools for continual improvement include quality management review, after action review, lessons learned, best practices, and quality metrics.

9-2. Quality Management Review. The relevant QMS will stipulate procedures for management review of production processes at project and organization levels.

9-3. After Action Review (AAR). An AAR is a professional discussion of an event focused on improving the performance of the organization or team. The focus of the AAR is analyzing what was supposed to happen, what actually happened, and why it happened. Through the AAR process, the team compares the actual outcome with the expected outcome of a program, project, event, activity or service, identifies gaps and corrective actions, and develops lessons learned. The AAR process is described in HQDA Training Circular 25-20, *A Leader's Guide to After-Action Reviews*.

a. Each PDT will conduct an AAR at the end of each major project phase.

(1) For Civil Works projects, an AAR should be conducted when these phases/events are completed: reconnaissance; planning; PED; and construction; one year after turnover; and every third year during O&M.

(2) For Military projects, an AAR should be performed when these phases/events are completed: planning charrette; design; construction; and the nine-month post-completion inspection.

(3) For HTRW projects, an AAR should be performed when these phases/events are completed: reconnaissance; feasibility, construction; and other major milestones associated with the program type.

(4) For all projects, an AAR should be performed when:

(a) An error or other significant change causes one or more of these conditions to occur: a cost increase of 5% or more; a design schedule slippage of 30 days or more; a construction time growth of 60 days or more; and/or a consequent reduction in project quality.

(b) An innovation has resulted in a significant project success.

b. After Action Reviews will be scheduled and budgeted for in the Project Management Plan. The PDT will determine the most efficient manner to accomplish the AAR.

c. AARs may be formal or informal, depending on the nature of the activity being assessed. All AARs will be documented in the project record. Lessons learned and best practices from the AAR will be documented and shared regionally.

d. Customers and stakeholders, including contractors, will be offered the opportunity to participate in each AAR. AAR results will be shared with customers.

e. The District Project Review Board (PRB) will provide oversight of the AAR results.

9-4. Lessons Learned. In accordance with Change Management PROC3010 and Activity/Project/Program Closeout PROC4000, ER 5-1-11 requires the PDT to capture Lessons Learned (LL) associated with project changes and whenever projects and/or phases of projects are completed. Lessons Learned PROC3020 establishes a general process for the PDT to capture project-related LL. Districts will develop detailed formal LL procedures within their QMS. The PDT will enter project LL into the ProjNet^{sm} module Design Quality Lessons Learned (DQLL^{sm}) or an alternate system for Corps-wide review. At project initiation, each PDT will review LL repositories for information pertinent to the project. The Regional Headquarters will ensure that Districts have and are using LL systems and are effectively capturing and sharing LL internally and with other Districts.

9-5. Best Practices. A Best Practice is a process, technique, or innovative use of technology, equipment or resources that has a proven record of success in providing significant improvement in cost, schedule, quality, performance, safety, environment or other measurable factors which impact an organization. Identifying and sharing best practices is another effective method for improving processes, products and customer satisfaction. The District should implement a procedure to identify, document and share best practices. The Regional Headquarters will identify best practices during District quality visits and communicate them across the region.

9-6. Quality Metrics. The District will develop metrics to measure and track progress with established quality objectives. Examples of metrics include, but are not limited to:

a. Customer Satisfaction.

b. Customer, End User, and Construction Contractor Surveys.

c. Controllable Cost Growth during construction.

d. Comparison of the Fair and Reasonable Estimate vs. the Baseline Estimate.

e. Low Three (3) Bids on Construction Contracts.

f. VE Composite.

g. Total Labor Multipliers (TLM).

h. Chargeability for Civil Design.

i. S&A Rate.

j. A-E Appraisals both before and after construction.

k. Construction Contractor Appraisals.

l. Cost Estimate and schedule changes during project development.

m. Number of Scope revisions.

n. Number of significant PDT, ITR and BCOE comments.

o. Number of significant Bidder Inquiries during advertisement.

p. Number of significant Contractor RFIs during construction.

q. Number of designer site visits requested during construction.

r. AARs completed for the project.

s. Number of Lessons Learned generated by the project.

t. Number of amendments during solicitation.

9-7. Process Improvements. Each QMS will prescribe procedures to measure conformity and conduct analyses that will lead to continual improvement. AARs, LL, and customer satisfaction surveys will be among the methods used to identify needs for corrective actions and process improvements. To select process improvements USACE organizations should consider such factors as:

a. Control. Will the improvement provide better control to ensure the project meets customer expectations?

b. Sustainability. Will the improvement provide better project results in a cost efficient way, over time and as conditions change?

c. Reliability. Will the improvement produce the intended results for all quality factors (e.g. better, cheaper, and faster) without lowering the quality of any single factor?

d. Feasibility. Is the improvement change for the sake of change, or will it provide real positive results? Will the improvement optimize performance at a cost acceptable to quality and the organization?

9 Appendices
(See Table of Contents)